CLAIMS:

1. An optical scanning device (1) for scanning an information layer (4) of an optical record carrier (2), the device (1) comprising a radiation source (11) for generating a radiation beam (12, 15, 20) and an objective system (18) for converging the radiation beam on the information layer, the information layer being covered by a transparent layer (3) of thickness t_d and refractive index n_d, the objective system being characterized in comprising a lens having a protection device projecting away from the lens towards the optical record carrier such that in use the distance between the protection device and the optical record carrier is less than the free working distance, the lens satisfying the condition:

$$0.8 < \frac{t - 1.1D + 1.1}{1.18 - 2.28\left[FWD + \frac{t_d}{n_d}\right]} < 1.2$$

where t is the thickness of the lens, D is the entrance pupil diameter, FWD is the free working distance, and D, FWD, t and t_d are expressed in millimeters and where $FWD + t_d/n_d < 0.51$.

2. A scanning device (1) as claimed in claim 1, wherein the lens satisfies the condition:

$$0.9 < \frac{t - 1.1D + 1.1}{1.18 - 2.28\left[FWD + \frac{t_d}{n_d}\right]} < 1.1$$

3. A scanning device (1) as claimed in claim 1, wherein the lens and the protection device are formed from the same material.

4. A scanning device (1) as claimed in claim 1, wherein the lens is formed of plastic.

5. A scanning device (1) as claimed in claim 1, wherein the Abbe number of the lens material is greater than 40.

6. A scanning device (1) as claimed in claim 1, the scanning device further comprising a detection system (25, 27) for converting radiation coming from the information layer to an information signal, and an information processing unit (29) for error correction of the information signal.

7. A lens system (18) comprising at least one lens for converging a radiation beam on an information layer (4) of an optical record carrier (2), the information layer (4) being covered by a transparent layer (3) of thickness t_d and refractive index n_d, the lens system being characterized in comprising a lens having a protection device projecting away from the lens towards the optical record carrier such that in use the distance between the protection device and the optical record carrier is less than the free working distance, the lens satisfying the condition:

$$0.8 < \frac{t - 1.1D + 1.1}{1.18 - 2.28\left[FWD + \frac{t_d}{n_d}\right]} < 1.2$$

where t is the thickness of the lens, D is the entrance pupil diameter, FWD is the free working distance, and D, FWD, t and t_d are expressed in millimeters and where $FWD + t_d/n_d < 0.51$.

8. A method for manufacturing a lens system (18) comprising at least one lens for converging a radiation beam (15) on an information layer (4) of an optical record carrier (2), the information layer (4) being covered by a transparent layer (3) of thickness t_d and refractive index n_d, the method comprising the step of:

forming a lens having a protection device projecting away from the lens towards the optical record carrier such that in use the distance between the protection device and the optical record carrier is less than the free working distance, the lens satisfying the condition:

$$0.8 < \frac{t - 1.1D + 1.1}{1.18 - 2.28\left[FWD + \frac{t_d}{n_d}\right]} < 1.2$$

where t is the thickness of the lens, D is the entrance pupil diameter, FWD is the free working distance, and D, FWD, t and t_d are expressed in millimeters and where $FWD + t_d/n_d < 0.51$.

9. A method as claimed in claim 8, wherein a plastic moulding process is utilized to form the lens.

10. A method as claimed in claim 8, wherein a single plastic injection moulding process is utilized to form both the lens and the protection device.

11. A method of manufacturing an optical scanning device (1) for scanning an information layer (4) of an optical record carrier(2), the information layer (4) being covered by a transparent layer (3) of thickness t_d and refractive index n_d, the method comprising the steps of:

providing a radiation source (11) for generating a radiation beam;

providing a lens system (18) for converging the radiation beam on the information layer (4), the lens system (18) being characterized in comprising a lens having a protection device projecting away from the lens towards the optical record carrier such that in use the distance between the protection device and the optical record carrier is less than the free working distance, the lens satisfying the condition:

$$0.8 < \frac{t - 1.1D + 1.1}{1.18 - 2.28\left[FWD + \frac{t_d}{n_d}\right]} < 1.2$$

where t is the thickness of the lens, D is the entrance pupil diameter, FWD is the free working distance, and D, FWD, t and t_d are expressed in millimeters and where $FWD + t_d/n_d < 0.51$.